GR/NR 323  
Remote Sensing and Image Analysis

Course number and title: GR/NR 323

Credits: 3

Term(s) to be offered: Fall (MW with lab on Friday)

Prerequisite(s): None

Course Description: Remote sensing systems and applications; characteristics of photographic, scanner and radar images; imagery interpretation.

Illustrative Course Content: Remote sensing theory and practice, systems and applications; characteristics of sensors and data; image processing; integration with GIS. Course is delivered mainly as a lecture course; labs provide hands-on learning and provide the student the opportunity to work through case study material related to lecture material.

Instructor: Stephen Leisz or Michael Lefsky. (Taught by each in alternating years)

Text(s): Aronoff, Remote Sensing for GIS Managers, ESRI Press, or Lillesand, Kiefer, and Chipman Remote Sensing and Image Interpretation, Wiley

Additional Class Material: ERDAS Imagine software, ArcGIS software, handouts on specific topics (on RamCT)

Course Objective(s). Students will: (1) develop a solid grasp of the physical principles underlying remote sensing; (2) be introduced to how the primary remote sensing data collection systems work (e.g. satellite sensors, aerial photographic systems, radar, etc.); (3) learn methods of interpreting and analyzing remote sensor data; (4) learn some of the uses and applications of remote sensing in the social and natural sciences and in the modern work place.

Course Topics/Weekly Schedule:
Week 1: Introduction: The history and evolution of remote sensing
Week 2: Basics of Remote Sensing: The foundation of aerial photography and satellite remote sensing: the principles of electromagnetic radiation and its interaction with the earth’s atmosphere; Introduction to ERDAS.
Week 4: Basic principles of photogrammetry: the geometry of air photos, scale, area measurement, relief displacement, radial displacement, parallax – Quiz 1
Week 5: The fundamentals of visual interpretation for air photos and satellite images
Week 6: Multispectral, hyperspectral, and thermal remote sensing systems – MID-TERM 1
Week 7: Spaceborne sensors: Characteristics of satellite based sensors
Week 8: Digital image analysis: Introduction to images
Week 9: Digital image analysis: Image enhancement – Quiz 2
Week 10: Digital image analysis: image classification 1 – unsupervised classifications
Week 11: Digital image analysis: image classification 2 – supervised classifications - MID-TERM 2
Week 12: Digital image analysis: image classification 3 – hybrid classifications
Week 13: Digital image analysis: Change analysis
Week 14: Accuracy assessment and error propagation – Quiz 3
Week 15: Microwave remote sensing: RADAR and LIDAR
Week 16: FINAL EXAM

Instructional Methodology: Two days a week the class will meet in a mixed lecture/discussion format. The lecture will focus on the key points of each week’s topic and make use of computer displayed examples and demonstrations. Discussion and questions will be encouraged. Each week’s lab session will provide practice in applying the methods demonstrated in the class lecture period. Examples of how remote sensing is applied to social science research, international development work, disaster relief, natural resource management, and in the contemporary workplace will be interwoven throughout the lectures. Labs will utilize cases drawn from the real-world as much as is possible.

Mode of Delivery: Classroom instruction via lecture / discussion format and remote sensing laboratory work on computer platforms.

Methods of Evaluation: Students will be evaluated on the basis of their weekly lab work, quizzes and three exams.

Quizzes: Three quizzes will be given during the semester. The date of each is indicated on the schedule, but is subject to change. Question format will be varied, and may include multiple-choice, fill-in, matching, true and false, problems, essay, and identification type questions. In general, each quiz will emphasize the material covered since the previous quiz or exam, including the material discussed in the previous lecture period.

Examinations: Three examinations will be given. The first two exams will include all materials assigned or presented through the previous week. The question format for all tests will be similar to that on the quizzes. The Final Exam will be given during the regular final exam week (16th week of the semester). It will include all material covered during the semester, but will emphasize the material covered since the second Exam.

Lab work: Each lab will explore a concept related to remote sensing that is covered in lecture. As an example the first lab will explore how a spectral signature is interpreted from a Landsat Thematic Mapper Image; the second lab will task the student with creating an uncontrolled photo mosaic in the ArcGIS computer environment; the third lab will have the student doing specific photogrammetric measurements manually; the fourth lab will have the student visually interpreting land cover using aerial photographs, the fifth lab
will have the student carrying out an unsupervised classification of a Landsat Thematic Mapper Image; the sixth lab will have the student carrying out a supervised classification of a Landsat Thematic Mapper Image; the seventh lab will have the student carrying out an accuracy assessment of the unsupervised and supervised classifications; the eighth lab will have the student carry out an object oriented classification of Ikonos high resolution imagery and carry out an accuracy assessment on the outputs; All labs will be graded on a 0 to 50 scale. 50 will indicate a total mastering of the material presented in the lab. Decreasing scores will indicate less of a mastery of the material.

**Course Grade:** Final course grades will be assigned on the basis of the following weights:

- **Quizzes** = 25%
- **First and second exams** = 25% (12.5% each)
- **Final exam** = 25%
- **Laboratory exercises** = 25%

Grade scheme:
- A = 90 – 100%
- B = 80 – 89%
- C = 70 – 79%
- D = 60 – 69%
- F = < 60%

(no plus / minus)